STATE UNIVERSITY OF NEW YORK
COLLEGE OF TECHNOLOGY
CANTON, NEW YORK

MASTER SYLLABUS

COURSE NUMBER – COURSE NAME
MECH 343 – Heat Transfer

Created by: Dr. Lucas Craig

Updated by:

Canino School of Engineering Technology !

Department: MET

Semester/Year: Spring 2019

A. **TITLE**: Heat Transfer

B. **COURSE NUMBER:** MECH 343

C. **CREDIT HOURS: (Hours of Lecture, Laboratory, Recitation, Tutorial, Activity)**

 # Credit Hours: 3
 # Lecture Hours: 3 **per week**
 # Lab Hours: **per week**
Other: **per week**

Course Length: 15 **Weeks**

D. **WRITING INTENSIVE COURSE**: Yes ☐ No ☒

E. **GER CATEGORY: None:** ☒ **Yes:** GER
***If course satisfies more than one*:** GER

F. **SEMESTER(S) OFFERED: Fall** ☐ **Spring** ☒ **Fall & Spring** ☐

G. **COURSE DESCRIPTION:**

This course explores the various methods of transferring heat from a source to a sink in engineering systems. Topics will focus on the energy balance of a system. The transport phenomena of heat transfer will be studied in detail, allowing students to internalize these physical principles of conduction, convection, and radiation.

H. **PRE-REQUISITES: None** ☒ **Yes** ☒ **If yes, list below:**

MATH 364

CO-REQUISITES: None ☒ **Yes** ☐ **If yes, list below:**

I. STUDENT LEARNING OUTCOMES: (*see key below*)

By the end of this course, the student will be able to:

Course Student Learning Outcome [SLO]	***Program Student Learning Outcome [PSLO]***	***GER*** *[If Applicable]*	***ISLO & SUBSETS***	
Define the transport methods of convection, conduction, and radiation.	2, 6		2-Crit Think ISLO ISLO	PS Subsets Subsets Subsets
Calculate the energy flow in combined transfer of conduction, convection, and radiation.	2, 6		2-Crit Think ISLO ISLO	PS Subsets Subsets Subsets
Calculate the coefficient of convection during laminar, turbulent, and separated flow.	2, 6		2-Crit Think ISLO ISLO	PS Subsets Subsets Subsets
Evaluate radiation from a blackbody, gray surface, and diffuse surface.	2, 6		2-Crit Think ISLO ISLO	PS Subsets Subsets Subsets
			ISLO ISLO ISLO	Subsets Subsets Subsets Subsets
			ISLO ISLO ISLO	Subsets Subsets Subsets Subsets

			ISLO ISLO ISLO	Subsets Subsets Subsets Subsets
			ISLO ISLO ISLO	Subsets Subsets Subsets Subsets
			ISLO ISLO ISLO	Subsets Subsets Subsets Subsets
			ISLO ISLO ISLO	Subsets Subsets Subsets Subsets

KEY	**Institutional Student Learning Outcomes [ISLO 1 – 5]**
ISLO #	**ISLO & Subsets**
1	**Communication Skills** Oral [O], Written [W]
2	**Critical Thinking** *Critical Analysis [CA] , Inquiry & Analysis [IA] , Problem Solving [PS]*
3	**Foundational Skills** *Information Management [IM], Quantitative Lit,/Reasoning [QTR]*
4	**Social Responsibility** *Ethical Reasoning [ER], Global Learning [GL], Intercultural Knowledge [IK], Teamwork [T]*
5	**Industry, Professional, Discipline Specific Knowledge and Skills**

*Include program objectives if applicable. Please consult with Program Coordinator

J. APPLIED LEARNING COMPONENT: Yes ☒ No ☐

If YES, select one or more of the following categories:

- ☒ Classroom/Lab
- ☐ Internship
- ☐ Clinical Placement
- ☐ Practicum
- ☐ Service Learning
- ☐ Community Service
- ☐ Civic Engagement
- ☐ Creative Works/Senior Project
- ☐ Research
- ☐ Entrepreneurship (program, class, project)

K. TEXTS:

Çengel, Y.A. & Ghajar, A.J., Heat and Mass Transfer: Fundamentals & Applications, 4th Edition, McGraw Hill, 2007.

L. REFERENCES:

N/A

M. EQUIPMENT: None ☒ Needed:

N. GRADING METHOD: A-F

O. SUGGESTED MEASUREMENT CRITERIA/METHODS:

Homework	**25%**
Exams (3)	**60%**
Final Exam / Project	**15%**

P. DETAILED COURSE OUTLINE:

I. Introduction
- **A. Origins of conduction, convection, radiation**
- **B. Conservation of energy**
- **C. Methodology for problem solving**
- **D. Overview of heat transfer applications**
- **E. Units and dimensions**

II. Conduction
- **A. Thermal properties of materials**
- **B. Boundary and initial conditions**
- **C. One-dimensional steady state conduction**
  - **1. Plane walls**
  - **2. Radial systems**
  - **3. Thermal energy generation**
  - **4. Transfer from extended surfaces (fins)**
- **D. Two-dimensional steady state conduction**
  - **1. Graphical method**

2. Finite-Difference equation
3. Nodal networks

III. Transient Conduction
A. Lumped Capacitance
B. Spatial effects
C. Semi-infinite solids
D. Multi-dimensional effects

IV. Convection
A. Boundary Layers
1. Velocity dependant
2. Thermal dependant
B. Laminar flow
C. Turbulent flow
D. Reynolds Analogy
E. Dimensionless Parameters

V. External flow
A. Flat plate
B. Cylinder in cross flow
C. Banks of tubes in heat exchangers

VI. Internal flow
A. Flow conditions
B. Friction factors of developed flow
C. Newton's Law of Cooling
D. Shell and tubes exchangers
E. Cross and parallel flow heat exchangers

VII. Free Convection
A. Laminar flow
B. Turbulent flow
C. Vertical and inclined surfaces and channels
D. Combined free and forced convection

VIII. Boiling and Condensation
A. Boiling of a pool
B. Nucleate boiling
C. Film boiling

IX. Radiation
A. Emission
B. Irradiation
C. Radiosity
D. Blackbody radiation
E. Absorption, reflection and transmission
F. Kirchhoff's Law
G. Gray surface
H. Exchange between surfaces
I. Radiation shielding

Q. <u>LABORATORY OUTLINE</u>: None ☒ Yes ☐